- $\underline{(fg)}' = f'g + fg'$

- $$f'(a) = \lim_{h\to 0} \frac{\overset{fg}{f(a+h) - f(a)}}{h}$$

- $$\lim_{h\to 0} \frac{f(a+h)\cdot g(a+h) - f(a)g(a)}{h} =$$

$$= \lim_{h\to 0} \frac{f(a+h)g(a+h) - f(a+h)g(a) + f(a+h)g(a) - f(a)g(a)}{h}$$

$$= \lim_{h\to 0} \frac{f(a+h)\left(g(a+h) - g(a)\right)}{h} + \frac{g(a)\left(f(a+h) - f(a)\right)}{h}$$

$$= \lim_{h\to 0} \underset{f(a)}{f(a\overset{\to 0}{+h})} \cdot \underbrace{\lim_{h\to 0} \frac{g(a+h)-g(a)}{h}}_{= g'(a)} + \underbrace{\lim_{h\to 0} g(a)}_{g(a)} \cdot \underbrace{\lim_{h\to 0} \frac{f(a+h)-f(a)}{h}}_{= f'(a)}$$

$$= f(a)\cdot g'(a) + g(a)\cdot f'(a)$$

$$\lim_{h\to 0} \sin\left(\frac{\pi}{2} + h\right) = \sin\left(\frac{\pi}{2} + 0\right) = \underline{\sin\frac{\pi}{2}} = 1$$

$$\lim_{h\to 0} \cos(\pi) = \cos\pi = -1$$

$$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

$y = \overset{\to 0}{h} + a$

$h = y - a$

$f(a + y - a) = f(y)$

$$f'(a) = \lim_{y \to a} \frac{f(y) - f(a)}{y - a}$$

Aim $\quad [f(g(a))]' = f'(g(a)) \cdot g'(a)$

$$\lim_{y \to a} \frac{f(g(y)) - f(g(a))}{y - a} =$$

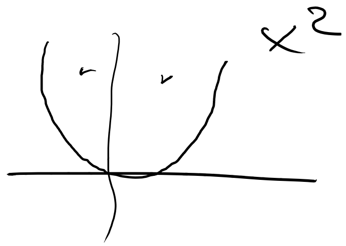
$$= \lim_{y \to a} \underbrace{\frac{f(\boxed{g(y)}) - f(g(a))}{g(y) - g(a)}}_{f'(g(a))} \cdot \underbrace{\frac{g(y) - g(a)}{y - a}}_{g'(a)}$$

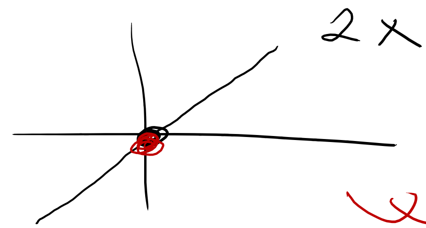
$$f'(a) = \frac{f(y) - f(a)}{y - a}$$

$$= f'(g(a)) \cdot g'(a) \qquad \blacksquare$$

$f = x^2$ $\quad$ $f' = 2x$

I am nonnegative even function





I am looking for the derivative which is straight line increasing goes through the origin.

$x^2 \geq 0$

even

odd increasing

straight line

Almost every time positive function
with a really symmetric smile
is looking for a derivative with
really straight character, which
knows its origin. Show me how
to grow.

$$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

$a+h$

$$f(x) = 3x^2 + 2 \qquad f'(x) = 6x + 0 = 6x$$

a

$$f'(a) = 6a$$

$$\lim_{h \to 0} \frac{3(a+h)^2 \cancel{+2} - (3a^2 \cancel{+2})}{h} =$$

$$\lim_{h \to 0} \frac{\cancel{3a^2} + 6ah + 3h^2 - \cancel{3a^2}}{h} =$$

$$\lim_{h \to 0} 6a + 3h = 6a + 0 = 6a \checkmark$$